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Lepus townsendii.

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Lepus townsendii Bachman, 1839

White-tailed Jackrabbit

Lepus campestris Bachman, 1837:349. Type locality "on the plains through which the North and South branches of the Saskatchewan flow," probably near Carlton, Saskatchewan.

Lepus townsendii Bachman, 1839:90. Type locality "on the Wallawalla, one of the sources of the Columbia River," near present town of Wallula, Walla Walla Co., Washington.

CONTEXT AND CONTENT. Order Lagomorpha, Family Leporidae, Subfamily Leporinae. The genus contains about 19 species (Honacki et al., 1982). Two subspecies of *L. townsendii* are recognized (Hall, 1981).

L. t. townsendii Bachman, 1839:90, see above. Includes *L. campestris sierrae* Merriam, 1904:132 (Orr, 1940).

L. t. campanius Hollister, 1915:70, see above. A renaming of *L. campestris* which was preoccupied by *Lepus cuniculus campestris* Meyer, 1790:55, a synonym for *Oryctolagus cuniculus*.

DIAGNOSIS. The most practical distinguishing characteristic between *Lepus californicus* (black-tailed jackrabbit) and *L. townsendii* is the color of the top of the tail, black in the former and white in the latter, hence their vernacular names. The skull of *L. townsendii* is relatively short, broad, and arched, and has large molariform teeth and prominent flanges projecting laterally from the dorsal margins of broad jugals (Fig. 1), whereas the skull of *L. californicus* is long, slender, and tapering, and has small molariform teeth and inconspicuous flanges on rather narrow jugals (Orr, 1940). The bullae of *L. townsendii* are proportionately smaller and the incisors not as prominently curved as in *L. californicus* (Nelson, 1909). Hall (1951) suggested that the skull of *L. t. campanius*, and not that of *L. t. townsendii*, can be distinguished from the skull of *L. californicus* where they are in sympatry east of the Rocky Mountains; *L. t. campanius* has a simple groove on the anterior face of the first upper incisor, whereas *L. californicus* has a bifurcation, or even trifurcation, of the infold of the enamel. However, there appears to be no absolute diagnostic skull character to distinguish the two species.

Lepus townsendii and *L. californicus* follow Bergman's rule, therefore the more northerly distributed white-tailed jackrabbits are larger than the more southerly distributed black-tailed jackrabbits (Grayson, 1977). There is, however, a broad area of overlap. Although ranges of alveolar length of the mandibular toothrow for both modern species were almost identical, their means were significantly different, with *L. townsendii* the larger. *L. townsendii* is significantly heavier (about 200 g) than *L. californicus* in northeastern Colorado (Flinders and Hansen, 1972).

GENERAL CHARACTERS. The pelage of white-tailed jackrabbits (Fig. 2) has yellowish (*L. t. campanius*) or greyish-brown (*L. t. townsendii*) upperparts (Nelson, 1909), and white or pale grey underparts excluding the darker throat (Bailey, 1926). In the mountains and northern parts of its range, where snowfall is regular, this species attains a thick white pelage in the winter (Nelson, 1909) with the possibility of a buffy tinge on the ears, face, back, and feet (Bailey, 1926); in the southern extent of its range they may not change color or may undergo only a partial change with the sides of the body and the rump whitish and the back a pale buffy-grey (Warren, 1910). The tail remains white throughout the year with the possibility of a slender buffy or dusky dorsal stripe that does not extend onto the lower back (Hall, 1951). The stripe usually is most prominent in *L. t. townsendii* (Armstrong, 1972). The tips of the ears are always black and there are no obvious color differences between sexes (Orr, 1940).

FIG. 1. Photographs of the dorsal, ventral, and lateral views of the skull, and lateral and dorsal views of the mandible of *Lepus t. townsendii* (ROM 20555 female) from 13 km SE Mountain View, Uinta Co., Wyoming, USA.

FIG. 2. Photograph of *Lepus townsendii* in winter pelage.

The juvenile pelage is similar to that of the adult but has more underfur showing because of relatively fewer and finer guard hairs, is duller in color on feet, ears, and throat, and has proportionately more guard hairs on the top of the tail (Orr, 1940).

Both cranial and external measurements of *L. t. campanius* average slightly larger than those of *L. t. townsendii* (Armstrong, 1972). Specimens of both subspecies from Wyoming average smaller than those from other localities (Long, 1965).

Means and ranges (in parentheses) of measurements (in mm) of eight adult males from southeastern Idaho and northeastern Nevada (Orr, 1940) are as follows: total length, 589.4 (565 to 618); tail length, 85.3 (72 to 102); length of hind foot, 153.1 (146 to 165); length of ear from notch in dried skin (six specimens), 104.3 (100 to 106); basilar length, 70.8 (67.6 to 74.0); zygomatic breadth, 43.5 (42.1 to 44.9); breadth of postorbital constriction, 14.1 (13.0 to 15.8); length of nasals, 38.6 (36.0 to 40.8); width of nasals, 20.0 (19.0 to 21.6); length of molariform row, 16.5 (15.8 to 17.6); diameter of external auditory meatus, 5.4 (4.9 to 6.1); breadth of braincase, 28.8 (26.6 to 30.6); length of palatal bridge, 5.6 (5.2 to 6.3). Means and ranges (in parentheses) of measurements (in mm) of eight females from the same area (Orr, 1940) are as follows: total length, 612.4 (575 to 655); tail length, 85.0 (66 to 100); length of hind foot, 154.9 (145 to 159); length of ear from notch in dried skin (seven specimens), 105.7 (100 to 113); basilar length, 72.0 (68.1 to 74.4); zygomatic breadth, 45.2 (44.3 to 46.7); breadth of postorbital constriction, 14.0 (12.3 to 16.0); length of nasals, 39.4 (37.9 to 40.3); width of nasals, 21.1 (19.1 to 21.8); length of molariform row, 17.1 (16.4 to 17.8); diameter of external auditory meatus, 5.5 (5.0 to 6.3); breadths of braincase, 29.1 (27.5 to 30.2); length of palatal bridge, 5.9 (4.9 to 7.2).

Sizes of the hind feet and ears increase toward adult size more rapidly than body mass (Bear and Hansen, 1966).

Body mass of two adult males, one from Idaho and the other from Nevada was 2,945 and 2,494 g, respectively (Orr, 1940), whereas mean and ranges of body mass of five adult females from the same area were 3,070 (2,635 to 3,440) g. Means and ranges (in parentheses) of body mass (in g) of 97 males and 101 females from Iowa during the winter were 3,400 (2,600 to 4,300) and 3,600 (2,500 to 4,300) respectively, and during the spring 13 males and 11 females were 3,100 (2,800 to 3,500) and 3,800 (2,800 to 4,400) respectively (Kline, 1963). The increase in average body

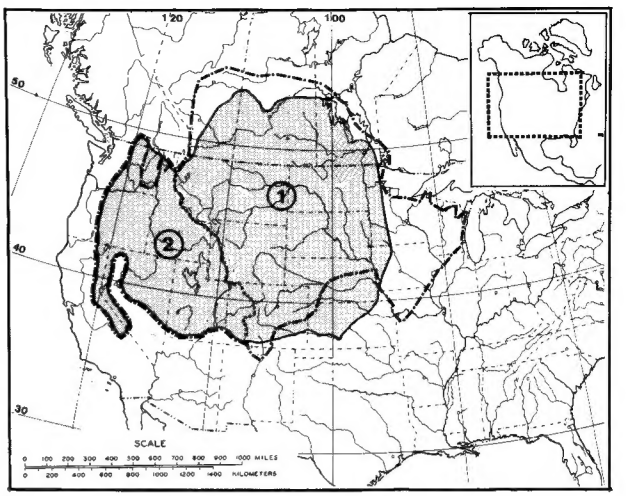

FIG. 3. The distribution of *Lepus townsendii*: 1, *L. t. campanius*; 2, *L. t. townsendii*. Shaded area is historical distribution and broken-lined area is present distribution.

mass of females was attributed to pregnancy, whereas the decrease in average body mass of males was attributed to the increase in activity associated with the breeding season. There were no significant differences in seasonal weights of either adult males or adult females from southern Colorado (Bear and Hansen, 1966).

Female *L. townsendii* are larger than males. In California, females were 3.2% longer than males (Orr, 1940). In southern Colorado (Bear and Hansen, 1966) and Iowa (Kline, 1963), females averaged heavier than males. In Nevada, females averaged 1% larger in external measurements and from 1% to 7% larger in most cranial measurements than males (Hall, 1946).

The degree of ossification of the epiphyseal cartilage at the proximal end of the humerus is used to estimate age (James and Seabloom, 1969). Among females, the relative size of reproductive tracts and skull dimensions are useful in distinguishing young from adults until March, after which there are no obvious differences (Hansen and Bear, 1963). Also, body mass can be used to estimate age in young animals and the penis can be everted in adult males but not in juveniles (Bear and Hansen, 1966). Males over 2 years of age usually have scrotal sacs that are darker blue or black and covered with less hair than those of younger adults, and ovaries of juvenile females are relatively smaller and consist of more interstitial tissue in comparison with those of adults (James and Seabloom, 1969).

DISTRIBUTION. The general distribution of *L. townsendii* (Fig. 3) encompasses the Great Plains in central Saskatchewan (Soper, 1952) south to the Rocky Mountains in extreme northern New Mexico (Bailey, 1931), and east of the Cascade Mountains in Oregon (Bailey, 1926) east to Lake Michigan in Wisconsin (Jackson, 1961). *L. t. campanius* occurs east of the Continental Divide, whereas *L. t. townsendii* occurs to the west (Armstrong, 1972).

There has been a gradual range expansion to the north and east by *L. townsendii* as favorable habitats are created. The conversion of forest to farmland and parkland has allowed a northeasterly expansion in Minnesota and Manitoba (De Vos, 1964). Human settlement and cultivation of the tall-grass prairie has resulted in an eastward spread through Iowa (Bowles, 1975). An invasion northward into Prince Albert National Park, Saskatchewan occurred subsequent to the clearing of agricultural lands (Soper, 1952).

There has been a gradual reduction of the geographic range of *L. townsendii* coupled with a range extension of *L. californicus* where habitats have been altered to favor the latter. In Nebraska, there has been a reduction of range in a northwesterly direction, possibly, as a result of a continental warming trend (Jones, 1964). A range retraction to the northwest has occurred in Kansas because of conversion of prairie to agriculture (Brown, 1947). Historically, the Arkansas River marked the approximate boundary between *L. townsendii* and *L. californicus* on the plains of eastern Colorado; however, cultivation, overgrazing, and drought have resulted in this boundary shifting north (Armstrong, 1972). In Washington, the

gradual disappearance of bunchgrass as the result of overgrazing by livestock probably has led to reduction of numbers and confinement of white-tailed jackrabbits to arid grasslands in the Okanogan Valley (Dalquest, 1948).

White-tailed jackrabbits from Minnesota were introduced into Wisconsin in 1908 and have thrived because they dispersed readily as a result of overpopulation (Jackson, 1920, 1961). In contrast, Hoffmeister and Grebner (1948) reported that *L. townsendii* was native to southwestern and westcentral Wisconsin and to northwestern Illinois west of the 89th parallel. Seton (1928) tried to introduce this species into Greenwich, Connecticut about 1900, but none survived the year.

The highest elevation at which *L. townsendii* has been positively identified is 4,319 m at the summit of Mt. Bross, Colorado (Hoeman, 1964) with a low of 30 m on the plains of the Columbia (Bailey, 1936). This represents the greatest range of any jackrabbit (Palmer, 1896).

FOSSIL RECORDS. From analysis of vertebrate faunas from archaeological sites in Fort Rock Basin, southcentral Oregon, the common early Holocene jackrabbit likely was *L. townsendii*; *L. californicus* did not become numerous until middle Holocene times with the change occurring between 7,000 and 5,000 years B.P. These data may represent the beginning of distributional and numerical changes that continue today. A warming trend during middle Holocene times permitted *L. californicus* to expand its range into that of *L. townsendii* with the former now being more common than the latter in the northern Great Basin region of Oregon and Washington (Grayson, 1977).

FORM AND FUNCTION. The winter molt occurs from October to November in southwest Colorado (Hansen and Bear, 1963) and from November to early December in Iowa (Kline, 1963), whereas the summer molt occurs from April to May in southwest Colorado and from March to early April in Iowa. *L. t. campanius* molts to summer pelage beginning around the eyes and on the lower back, progressing to the head and cheeks, then the rump and sides, and finally the ears; the reverse process occurs for the winter molt (Jones et al., 1983). There also are two maturational molts that are similar to the summer molt (Jones et al., 1983).

The dental formula for *L. townsendii* is i 2/1, c 0/0, p 3/2, m 3/3, total 28. There usually are four pairs of mammae, one inguinal, two abdominal, and one pectoral (Bailey, 1926).

In Wyoming, skulls of females exhibited clinal variations (Long, 1965). Width of the interpterygoid space decreased in a north to south pattern and width of the palatal bridge increased anteroposteriorly in a northeast to southeast pattern.

Captive individuals produced an average of 277 fecal pellets (range of 146 to 440) per day with a dry weight of 24 g (Bear and Hansen, 1966). These investigators also suggested that *L. townsendii* reingests its own amorphous, soft pellets, usually during late morning hours. These pellets are found in the cardiac portion of the stomach of dissected specimens.

The basal metabolic rate for an adult in northeastern Colorado was estimated at 53.14 kilocalories (kg body mass)$^{-1}$ day^{-1} (Flinders and Hansen, 1972).

ONTOGENY AND REPRODUCTION. The breeding season for *L. townsendii* begins in late February and can extend for 148 days in North Dakota. A maximum of four litters are produced per year, one each in late April, early June, middle July, and late August or early September (James and Seabloom, 1969). However, in the northern extent of the range only one litter is produced each year between May and early July (Bailey, 1926; Soper, 1973). The number of litters may be influenced by breeding conditions and environmental factors.

According to Kline (1963), the gestation period is 42 days. However, Soper (1973) reported a gestation period of only 1 month in Alberta, whereas Peterson (1966) reported a range of 36 to 43 days. Elevation and latitude may be factors influencing the gestation period. Litter size ranges from one to 11 with four or five young most common (Bear and Hansen, 1966).

The sex ratio of *L. townsendii* is essentially equal (Flinders and Hansen, 1972; Kline, 1963), and the species is polygamous (Jackson, 1961).

Lepus t. campanius exhibits breeding synchrony. The testes descend into the scrotal sac just before peaks in nuptial chasing, and a postpartum estrus allows conception immediately after parturition (James and Seabloom, 1969; Kline, 1963). Also, fetuses in gravid females collected within the same week are at the same stage of gestation (James and Seabloom, 1969).

The reproductive system of *L. t. campanius* shows definite annual changes in morphology. February is characterized by dramatic increases in testicular mass, March is characterized by dramatic increases in epididymal mass, testicular turgidity, and sperm in the epididymides, and late July marks the cessation of male breeding capacity (James and Seabloom, 1969). March is characterized by dramatic increases in ovarian mass and size (James and Seabloom, 1969). Mammary tissue attains a maximum in June and female breeding capacity ceases by autumn (Bear and Hansen, 1966). The reproductive cycle of females tends to lag behind and develop slower than that of males.

Uteri of nulliparous females are compact and smooth. During the first pregnancy, uteri become greatly enlarged and longitudinal striations develop in the uterine wall. The striations remain throughout the life of the female, therefore, these can be used to distinguish between juveniles and adults. Absence of these striations is characteristic of virgins (James and Seabloom, 1969).

In North Dakota, the average number of ova shed per female was highest for the first littering period and declined progressively to a low for the last littering period with a mean of about six (James and Seabloom, 1969). The expected reproductive potential was estimated as 23 young per year; however, the reproductive potential averaged 15. This was the result of prenatal mortality such as preimplantation loss of ova and resorbed embryos. For Iowa, similar results were reported (Kline, 1963).

Young obtained by caesarian operation by Bear and Hansen (1966) in Colorado were fully furred, eyes open, incisors exposed below the gum line, and mobile to a limited extent within 0.5 h. Newborns weigh approximately 90 g and growth appears equal in both sexes until sexual maturity the following spring when females become slightly larger.

In southern Colorado, a 4-week-old male *L. t. townsendii* had both milk and plant material in its stomach (Sparks, 1968). In North Dakota, a quarter-grown *L. t. campanius* had a mixture of curd and green vegetation in its stomach (Bailey, 1926). Young begin to forage when about 15 days old but are not completely weaned until about one-fourth adult size and become independent of maternal care at about 2 months of age or about half adult size (Jackson, 1961).

Individuals have the potential to breed as early as 7 months of age, but there is no evidence of juvenile breeding (James and Seabloom, 1969). Maximum longevity is about 8 years (Jackson 1961).

ECOLOGY. *Lepus townsendii* is essentially herbivorous and feeds primarily on succulent grasses and forbs; shrubs are consumed when these foods become dry in the winter. The species tends to consume grasses and forbs that are in a prereproductive or early reproductive stage of development. When feeding on shrubs, woody stems are eaten more frequently than leaves or recent growth. Young tend to feed more on grasses than on shrubs. Dietary selection also is influenced by the availability of plant species in the feeding habitat (Bear and Hansen, 1966).

In Alberta, alfalfa (*Medicago sativa*) exposed through the snow cover is the main food (Brunton, 1981). In California, creambush (*Holodiscus discolor*) is the primary food, but sagebrush (*Artemisia* sp.) is eaten in the winter (Orr, 1940).

By examining stomach contents of *L. t. campanius* from southern Colorado, Bear and Hansen (1966) calculated that the average diet of both sexes during the summer consisted of 70% forbs, 19% grasses, and 7% shrubs. The four most abundant plants, accounting for 60% of the stomach contents, were clover (*Trifolium* sp.), common dandelion (*Taraxacum officinale*), dryland sedge (*Carex obtusata*), and Indian paintbrush (*Castilleja integra*) in decreasing order of abundance. The average diet of both sexes in autumn consisted of 43% grasses, 34% forbs, and 14% shrubs with dryland sedge, goosefoot (*Chenopodium* sp.), fringed sage (*Artemisia frigida*), and winterfat (*Eurotia lanata*) accounting for 60% of the stomach contents. The average diet of both sexes in winter consisted of 76% shrubs and 12% forbs, with Parry's rabbitbrush (*Chrysothamnus parryi*) accounting for 72% of stomach contents. The average diet of both sexes in spring consisted of 87% shrubs, 4% grasses, and 4% forbs, with Parry's rabbitbrush accounting for 70% of stomach contents. The food available and the diet in both winter

and spring were similar. Of 42 species of plants eaten, 19 were grasses, 18 forbs, and 5 shrubs.

Captive individuals were reported to consume an average of 0.42 kg of alfalfa hay and rolled barley per day; females, following parturition, ate progressively larger amounts of food (Bear and Hansen, 1966). The ratio of alfalfa to barley eaten was 0.54 to 1.

In northeastern Colorado, 67 plant species, composed of 16 species of grasses and sedges and 51 species of forbs and shrubs, were consumed (Flinders and Hansen, 1972). Western wheatgrass (*Agropyron smithii*) composed 21% of the diet, winter wheat (*Triticum aestivum*) 20%, and summer cypress (*Kochia scoparia*) 7%. There were no significant differences between sexes in type of food selected or by time of year. Where sympatric, black-tailed jackrabbits possibly are more efficient than white-tailed jackrabbits in foraging for food, therefore possess a competitive advantage (Flinders and Hansen, 1972). *L. townsendii* seems to be more selective in feeding than *L. californicus* even though the former consumed 67% of the available plant species in the feeding habitat at sometime during the study.

In southern Colorado, *L. townsendii* uses different vegetative types seasonally (Bear and Hansen, 1966). Meadowlands were used infrequently in summer but progressively more so after the harvest in autumn. Grassland was the most used habitat by a multiple of four over rabbitbrush, sagebrush, and meadowland with the last being least used. However, white-tailed jackrabbits were observed in nearly equal numbers in both grassland and meadowland habitats during winter. Frequency of pellet deposits were used to indicate amount of use, however, pellet disintegration was much more rapid in meadowlands than in other habitats.

Where sympatric, white-tailed and black-tailed jackrabbits use different habitats. The former occurs in open flats and ryegrass fields in Oregon (Anthony, 1913), and bunchgrass and rabbitbrush in Washington (Couch, 1927); the latter occurs predominantly in sagebrush. In Mono Co., California, *L. t. townsendii* was observed more frequently on higher slopes and ridges, and *L. californicus* more frequently on valley floors (Severaid, 1950). In eastern Washington, *L. t. townsendii* was found on arid, hilly bunchgrass sites during the summer and in lower sagebush valleys during winter (Dalquest, 1948).

Although the white-tailed jackrabbit is more accustomed to open plains, it sometimes takes shelter in forested areas during severe winter weather, although not penetrating them greatly (Bailey, 1926; Kline, 1963). In winter, they established pathways on grass-dominated ridges cleared of snow by the wind (Bear and Hansen, 1966).

The white-tailed jackrabbit has been recorded throughout the year in the alpine zone and above timberline in Colorado. They are common in the tundra region where sparse snow cover makes food more readily available and traveling easier than below timberline during the winter (Braun and Streeter, 1968).

Average density of populations in Iowa ranged from 3 to 9/km^2 with a reported high of 71 (Kline, 1963). In Minnesota, usual winter densities ranged from 6 to 12/km^2 with a high of 43 (Mohr and Mohr, 1936). Winter population density on the shortgrass prairie of northeastern Colorado was 2.2/km^2 (Flinders and Hansen, 1973).

Although white-tailed jackrabbit may eat young trees and bushes, little overall damage results because of low jackrabbit numbers (Bailey, 1926). Wet seasons may cause decline of jackrabbit numbers (Kline, 1963), and dry growing seasons may increase populations (Mohr and Mohr, 1936).

The most common censusing methods are applied during the night with a spotlight because the retinas of white-tailed jackrabbits reflect light (Bear and Hansen, 1966; Flinders and Hansen, 1972; James and Seabloom, 1969). Pellet droppings on the ground also have been used to estimate populations (Bailey, 1926).

Anthony (1913) reported that, in Oregon, the white-tailed jackrabbit was considered edible, especially during winter. *L. townsendii* is considered an endangered species in Missouri and hunting of it is prohibited (Watkins and Nowak, 1973). The hunting season in Iowa begins in the middle of December and lasts into February with the hare being sold without any skinning or other preparation to furbuyers and also mink ranchers as animal food (Kline, 1963). In Wisconsin, pelts were used primarily in the manufacturing of fur hats because they were too fragile to withstand the processing for clothing (Jackson, 1961).

The home range of *L. townsendii* has been reported as 2 to 3 km in diameter (Jackson, 1961; Seton, 1928); however, research is lacking.

Predators include coyotes (*Canis latrans*), grey wolves (*Canis lupus*), red foxes (*Vulpes vulpes*), martens (*Martes americana*), weasels (*Mustela* sp.), lynxes (*Lynx canadensis*), bobcats (*Lynx rufus*), golden eagles (*Aquila chrysaetos*), and hawks (*Buteo* sp.; Dalquest, 1948; Fry, 1924). Traces of *L. t. campanius* have been found in the pellet debris of the great-horned owl (*Bubo virginianus*) from eastern Wyoming (Long and Kerfoot, 1963) and western Nebraska (Rickart, 1972).

Endoparasites of *L. t. campanius* from southwestern North Dakota include the protozoa *Eimeria* sp. found in epithelium and connective tissues of the intestinal villi; the tapeworm *Cittotaenia* sp. in the small intestine; the tapeworm coenuri of *Multiceps* sp. in the skeletal muscles, the thoracic cavity, and in the right ventricle of the heart; the tapeworm cestode *Raillietina loeweni* in the small intestine; the tapeworm cysticerci of *Taenia pisiformis* in the visceral mesenteries and clustered around the rectum; and roundworm filariid species in the circulatory system (Voth and James, 1965). Hall (1916) reported the occurrence of the nematode *Dirofilaria scapiceps* subcutaneously and under muscular fasciae. Bartlett (1983), however, did not find this parasitic species or a similar species *Dirofilaria uniformis* upon examining hind legs of 50 specimens from Alberta.

Ectoparasites include the fleas *Cediopsylla inaequalis*, *Hoplosyllus affinis*, and *Pulex irritans*; and the tick *Dermacentor andersoni* (Voth and James, 1965). The latter occurs on the head and neck region but infrequently during the summer. Other ectoparasites include the louse *Haemodepus setoni* and the flea *Hoplopsyllus lynx* (Jackson, 1961).

Diseases associated with the white-tailed jackrabbits include Colorado tick fever, equine encephalitism and fever caused by heavy infestation of *Cuterebra* (botfly) larvae (Banfield, 1974), in addition to tularemia and papillomas (Kline, 1963).

BEHAVIOR. *Lepus townsendii* is one of the least sociable hares, tending to be solitary, but three or four individuals may group together during the mating season (Banfield, 1974). However, Lahrman (1980) observed average aggregations of about 50 white-tailed jackrabbits diurnally with a maximum of 110 in Saskatchewan during two successive winters, and Brunton (1981) made similar nocturnal observations on an open fallow field in Alberta. These unusual observations were attributed to an abundance of food in the area.

White-tailed jackrabbits, like most animals, are nocturnal. During the day this species usually hides in forms that are shallow holes dug at the base of bushes or beside rocks (Dalquest, 1948). The size of the form is about 46 to 61 cm long, 20 to 30 cm wide, and up to 20 cm deep (Jackson, 1961). In winter, they may rest during the day in cavities connected by tunnels dug about 1 m into the snow (Bailey, 1926; Bear and Hansen, 1966).

Lahrman (1980) observed a group huddled together with an occasional individual stretching, yawning, or moving about instead of trying to conceal themselves during the daylight hours. He also noted that when cold winter winds blew, hares aligned their backs towards the wind rather than seeking shelter.

Nests for young are made of dry leaves and grasses, heavily lined with the hair of the mother, and well hidden in bushes or vegetation (Fry, 1924). In Wisconsin, Jackson (1961) reported that a true nest is not provided for young, but they are born in a form or on bare ground.

Newborns invariably sleep during the day and are active at night, usually grooming each other (Bear and Hansen, 1966). Young have been heard to emit shrill squealing cries when frightened or distressed (Fry, 1924; Jackson, 1961).

White-tailed jackrabbits often abandon their form when an intruder is almost upon it, and bound off quickly (Bailey, 1926). The gait has been described as a halting, one-sided lope with frequent glances over the shoulder (Anthony, 1913). If pressed by a pursuer, this species may flee in a zigzag pattern (Gunderson and Beer, 1953) and sometimes enters water in attempts to elude a predator; they swim with their forefeet in a paddling fashion (Jackson, 1961). This species runs with difficulty in fresh snow deeper than 25 cm (Bear and Hansen, 1966).

Cottam and Williams (1943) estimated the running speed of a white-tailed jackrabbit at 55 km/h by use of a car speedometer. They may cover up to 5 m per stride (Jackson, 1961).

Whishaw et al. (1978) demonstrated tonic immobility behavior in *L. townsendii* for a number of positions, with the "front posture" having the longest duration. This behavior is believed to serve a

defensive function similar to feigned death. It appeared that experimentally induced immobility closely exhibited spontaneous immobility as observed when danger is sensed.

White-tailed jackrabbits feed primarily between sunset and sunrise, seldom during daylight. Young that weigh less than 1 kg usually do not forage or move about during the day. Lactating females possibly feed earlier in the evening and later in the morning than other hares. Pregnant or lactating females usually are observed to feed alone, whereas males feed in groups of two to five animals (Bear and Hansen, 1966). After feeding they groom their heads and ears with their forepaws, and lick their bodies (Jackson, 1961).

Blackburn (1968) reported that the courtship behavior of white-tailed jackrabbits was essentially the same as that observed in black-tailed jackrabbits. He described it as an encounter between opposite sexes with a series of circling, jumping, and chasing activities lasting from 5 to 20 min and usually ending in copulation. Nuptial behavior occurs from March through to August with groups of three to five males chasing one female usually during evening hours (Bear and Hansen, 1966).

GENETICS. A study of the G- and C- banded chromosomes on six species of the genus *Lepus*, including *L. townsendii*, showed no noticeable variation in either the gross chromosome morphology or banding pattern, indicating that speciation in this genus has not involved karyotypic change (Robinson et al., 1983). All species of *Lepus* including *L. townsendii* have a diploid number of 2n = 48.

Hsu and Benirschke (1971) described the metaphase karyotype as 42 metacentric and submetacentric autosomes, 4 acrocentric autosomes, and submetacentric X and acrocentric Y sex chromosomes in unbanded preparations. Robinson et al. (1983) described the haploid G-banded karyotype for a female as 8 pairs of metacentric and submetacentric autosomes and 15 pairs of subtelocentric and acrocentric autosomes with a submetacentric sex chromosome.

Jalal et al. (1967) used C-metaphase cells from peripheral-blood leucocyte culture and bone-marrow preparations to determine the diploid chromosome number and karyotype. The chromosome number ranged from 46 to 49 with 48 the most common. They suggested that this range was caused by use of colchicine in treatment of cells that resulted in appearance of some polyploid cells. They found lengths of the chromosomes between 1.5 and 6.5 microns.

With C-banding, small traces of heterochromatin, distributed pericentromerically, were found in most chromosomes, indicating euchromatic conservatism within the genus (Robinson et al., 1983).

A polytypic winter coat has been observed in this species from the Cochetopa area of Colorado and it is thought that incomplete dominance of two or more alleles, or pairs of genes are involved (Hansen and Bear, 1963).

REMARKS. In the scientific name, *Lepus* comes from the Latin word for hare and *townsendii* is the Latinized word meaning "of Townsend" in recognition of J. K. Townsend who collected the type specimen. In the common name, white-tailed describes the color of the top of the tail, jack refers to the resemblance of the hare ears to those of the jackass, and rabbit is from the Middle English word *rabet* (Schwartz and Schwartz, 1959).

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